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Antioxidant and Antibacterial Activities of Coriander (*Coriander sativum* L.) Seeds Essential Oil

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Natural products offer a wide range of possibilities for the development of new remedies. Coriander (*Coriandrum sativum* L.) seeds have been reported to contain numerous biological activities. This study aims to determine the antioxidant and antibacterial activities of coriander seeds essential oil. The essential oil was obtained using the hydrodistillation technique from non-soaked and soaked coriander seeds. The antioxidant activity was determined using the DPPH assay, while the antibacterial activity of the essential oil was determined using the Kirby-Bauer disc diffusion method against three Gram-positive bacteria: *Staphylococcus aureus* (ATCC 12600), *Staphylococcus epidermidis* (ATCC 12228), and *Bacillus cereus* (ATCC 14579). The yield of essential oil for soaked coriander seeds (0.79%) was higher than that of non-soaked coriander seeds (0.54%). The DPPH assay disclosed that the essential oil obtained from non-soaked coriander seeds had inactive antioxidant activity. Furthermore, the antibacterial activity of the essential oil from soaked seeds showed a potent antibacterial effect on *B. cereus* and *S. aureus* bacteria at 14.99 mm and 14.90 mm, respectively, while the essential oil from non-soaked seeds showed a potent antibacterial effect on *S. epidermidis* at 8.70 mm. In conclusion, coriander seeds essential oil can be developed as a new and effective antibacterial agent by showing the inhibition zone on bacteria through these studies, which can treat infections that cause human diseases.

Keywords: *Coriandrum sativum* L; soaking; non-soaking; antioxidant; antibacterial

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Free radicals, or oxidative stress, are one of the factors that cause the aging process [1]. Free radicals accumulate in cells due to excessive reactive oxygen species (ROS) and inadequate antioxidant defence mechanisms, leading to oxidative stress. Oxidative stress in cells causes damage to DNA, cell membranes, and mitochondrial DNA [2]. One class of chemicals known as ROS are oxygen-based or oxygen-containing active compounds. Superoxide anion ($\bullet O_2^-$), hydrogen peroxide (H_2O_2), the extremely active hydroxyl radical ($\bullet OH$), singlet oxygen, lipid peroxides, and nitrogen oxides are examples of ROS in the body. The human body normally has enzymatic and non-enzymatic anti-oxidant defence mechanisms to maintain the balance between free radicals and antioxidants by eliminating excess ROS [3]. According to Kassahun et al. (2020), the function of antioxidants is to stop or slow down these chain reactions by eliminating or oxidizing free radicals to prevent subsequent oxidation reactions [4]. Antioxidants, including vitamins C and E and glutathione, can be found in plants and mammals. They also possess some enzyme systems that catalyze antioxidant reactions, including catalase, superoxide dismutase (SOD), and peroxidase [5].

Meanwhile, antibacterial resistance has become a serious threat to public health as bacterial resistance is rapidly developing and spreading. The increase in bacterial resistance has resulted in several antibacterial agents being less effective [6]. This limits the therapeutic options for treating bacterial infections and leaves patients with few alternatives. According to the World Health Organization (WHO), infectious diseases are the second leading cause of death worldwide [7]. Therefore, it is crucial to search for new alternative antibacterial agents to combat the problem of bacterial resistance. The antibacterial agents in coriander seeds are potent enough to fight microorganisms [8]. For example, the double bonds in the structure of the monoterpenoid alcohol compounds, such as linalool, confer strong antibacterial properties [8].

Coriandrum sativum L. (*C. sativum*) is a plant from the Apiaceae or Umbelliferae family [5]. The medicinal plant is commonly used as a spice to enhance flavor in food preparation. *C. sativum*, which can grow up to 1.4 meters tall, is known by different names in different countries, including 'yuan sui' in China, 'ketumbar' in Malaysia, 'cilantro' in Spain, 'geshniz' in Iran, and 'coriander' in America [9, 10]. Valuable parts of the plant's dry schizocarp include two ovoid round mericarps and several longitudinal grooves on the surface, which are found in the seeds or fruits [11]. The taste is sweet, spicy, citrusy, and

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